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AUTHOR	Koplyay, Janos B.
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ABSTRACT

A weighted factors promotion system was field tested and validated using data from the FY 69-B promotion cycle of the Alaskan Air Command. The final sample included 2,290 promotion-eligible airmen in grades E-3 through E-6. The weighted factors composite score, excluding a promotion board component, gave airmen the same relative rank within selected Air Force Specialties as did the promotion board evaluations under the present operational system. Overlaps between the two ranks imply promotion of the same individuals by both systems. However, inconsistencies and unexplainable discrepancies in the ranking by promotion board scores were found in some few instances. It was concluded that, within the specialties analyzed, practically all the individuals promoted by the board system would also have been promoted under the weighted factors system. If it can be assumed that the sample was representative of the Air Force-wide population of promotion-eligible airmen in grades E-3 through E-6, then it can be further assumed that the weighted factors system provides a valid airman promotion system in which the selection criteria are visible and equitable. (Author)

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FIELD TEST OF THE WEIGHTED AIRMAN PROMOTION SYSTEM: PHASE II. VALIDATION OF THE SYSTEM FOR GRADES E-4 THROUGH E-7

By

Janos B. Koplyay

PERSONNEL RESEARCH DIVISION
Lackland Air Force Base, Texas

May 1969

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SMA: 3570

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AIR FORCE HUMAN RESOURCES LABORATORY
AIR FORCE SYSTEMS COMMAND
Lackland Air Force Base, Texas

FOREWORD

This research was completed under Project 6323, Personnel Management Research and Development; Task 632305, Development of Statistical and Mathematical Procedures to Facilitate Personnel Research.

This report has been reviewed and is approved.

F.L. McLanathan, Lt Col, USAF
Chief, Personnel Research Division

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ABSTRACT

A weighted factors promotion system was field-tested and validated using data from the FY 69-B promotion cycle of the Alaskan Air Command. The final sample included 2,290 promotion-eligible airmen in grades E-3 through E-6. The weighted factors composite score excluding a promotion board component gave airmen the same relative rank within selected Air Force Specialties as did the promotion board evaluations under the present operational system. Overlaps between the two ranks imply promotion of the same individuals by both systems. However, inconsistencies and unexplainable discrepancies in the ranking by promotion board scores were found in some few instances. It was concluded that, within the specialties analyzed, practically all the individuals promoted by the board system would also have been promoted under the weighted factors system. If it can be assumed that the sample was representative of the Air Force-wide population of promotion-eligible airmen in grades E-3 through E-6, then it can be further assumed that the weighted factors system provides a valid airman promotion system in which the selection criteria are visible and equitable.

SUMMARY

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Problem

In response to a research requirement levied by the Deputy Chief of Staff for Personnel, Headquarters, United States Air Force, the Personnel Research Division developed a model for a new airman promotion system. The purpose of this new promotion system was to provide more visibility to each airman in terms of numeric values on selected variables indicating their relative performance on these variables. This, in turn, provides visible evidence and information about the reasons for non-promotion in terms of easily interpretable scores.

The new promotion system (Weighted Airman Promotion System) was field-tested in the Alaskan Air Command (Koplyay, 1969). One of the major purposes of this field test was to obtain validation data. The operational definition of validation was assumed to be the relationship between the Weighted Airman Promotion System and the existing Promotion Board system in terms of the percentage of promotion-eligible individuals who would have been promoted by both systems.

Approach

To ascertain the predictive efficiency of the Weighted Airman Promotion System, a validity index was computed by identifying those individuals who would have been selected for promotion by both the Composite Score of the new system and the Board Score of the existing system. This validity index was computed for the entire sample of 2,290 airmen by grade (555 in grade E-3, 850 in grade E-4, 514 in grade E-5, and 371 in grade E-6), and was further analyzed by grade within selected specialties.

Results

The validity indices ranged from 43.5 percent (grade E-6) to 91.4 percent (grade E-3) for the entire sample. These results, however, are lower-limit estimates for the validity of the new system, since the existing promotion system operates on the basis of differential quotas assigned to the various specialties. The validity indices within grade and selected specialties ranged from 84 percent to 100 percent with two-thirds of the specialties analyzed having validity indices of 100 percent.

Conclusions

The Weighted Airman Promotion System gave most airmen the same relative ranking within their specialty as did the Promotion Board system. In other words, with a limited number of exceptions, the same individuals would have been promoted using either system.

If the sample in the study can be considered to be representative of the Air Force-wide population of airmen in grades E-3 through E-6, it can be further assumed that the Weighted Airman Promotion System is not only a visible system but it is valid in the sense of the operational definition of validity used in this study.

This summary was prepared by J.B. Koplyay, Statistical Analysis Branch, Personnel Research Division, Air Force Human Resources Laboratory.

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FIELD TEST OF THE WEIGHTED AIRMAN PROMOTION SYSTEM: PHASE II. VALIDATION OF THE SYSTEM FOR GRADES E-4 THROUGH E-7

I. INTRODUCTION

The Weighted Airman Promotion System was developed, field-tested in the Alaskan Air Command, and evaluated in response to a research requirement levied by the Deputy Chief of Staff for Personnel, Headquarters, United States Air Force. Briefly, the system provides for selection of airmen for promotion to grades E-4 through E-7 on the basis of seven weighted factors designed to insure visibility and equitable application of the selection criteria. One of the seven factors is a promotion board evaluation. The extent to which inclusion of this board score as a component in the proposed system changed the relative standing of promotion-eligible individuals was discussed in the report of the first phase of this study (Koplyay, 1969). In general, the initial findings indicated that inclusion of the board component made only an insignificant difference in the ranking of airmen who were eligible for promotion. The seven factors and their computations or weights are shown in the appendix.

One of the major purposes of the Alaskan Air Command field test of the proposed weighted factors promotion system was to obtain validation data. Validation is a very general concept, and it can be interpreted in a variety of ways.

In this report, the operational definition of validation is assumed to be the relationship between the weighted factors composite score, excluding the average board score, and the actual promotion actions. Since promotions under the existing system are based on promotion board scores, validation of the weighted factors system dealt with analyses of relationships between the weighted factors system and the promotion board system. That is, if the same individuals were identified for promotion by the weighted factors system as were actually promoted under the existing system, then the weighted factors composite score can be considered a valid indicator (predictor) of promotion. In this context, it is always true that any unreliability in the criterion variable places an upper limit on the validity of any predictor. If the promotion board score has a less than perfect relationship with promotion actions, it is impossible to develop any kind of system to duplicate it. In this report, two general indicators are used to express the validity of the proposed weighted factors system. One is the comparison of the weighted factors composite scores with actual promotion actions. The other reflects directly the relationship between the proposed system and the promotion board system.

This report focuses primarily on three specific areas:

1. The relationship between promotion board score and promotion action.

2. The agreement between rank standing on the weighted factors composite score excluding the board score and rank standing on the promotion board score for the total sample and for selected Control Air Force Specialties.

3. The analysis of groups with large discrepancies between rank on the weighted factors composite score and rank on the board score.

II. PROCEDURE

Description of the Sample

The Alaskan Air Command provided data for 2,835 airmen in grades E-3 through E-6 who were eligible for promotion in the FY 69-B cycle. All factors except the Promotion Fitness Examination Scores were provided on punched cards by Consolidated Base Personnel Offices at Elmendorf and Eielson Air Force Bases. The Promotion Fitness Examination was administered separately, and scores were added to the record of each airman in the sample. Promotion board scores were given in raw score form as the sum of the ratings of individual promotion board members. There were both three-man and five-man boards.

Treatment of the Data

A number of steps were taken to obtain usable and meaningful data for analysis.

1. Promotion Fitness Examination scores were added to the data tape containing the card images of punched cards provided by the Alaskan Air Command.

2. Records were excluded from further analyses if Specialty Knowledge Test scores or Promotion Fitness Examination scores were missing, or if non-matching and uncorrectable serial numbers and names were detected during the merging of input data tapes. As a result, 2,290 airmen (555 in grade E-3, 850 in grade E-4, 514 in grade E-5, and 371 in grade E-6) were retained in the study for further analyses.

3. Promotion board raw scores were converted to a scale, with a 100-point maximum score (see Appendix). Each raw score was divided by the appropriate number of board members, and the quotient was multiplied by 10. The resulting score gave an average board score for each airman. (Before adopting the procedure of generating the average board score, a preliminary analysis of the data had shown that the variability of the resulting scores would be approximately constant among grades.) In case of ties in average board scores, an attempt was made to break these ties by consideration of the Time-in-Grade, Airman Performance Report, and Decorations scores, in that order. (This was in accordance with the policy of the promotion board, but it did not eliminate ties altogether.) The average board score, then, was added to each airman's record. This score is referred to simply as the Board Score in the remainder of this report.

4. Time-in-Grade and Time-in-Service scores were recomputed using Date of Rank, Total Active Federal Military Service Date, and the date 1 January 1969 for airmen in grade E-3 and 1 May 1969 for airmen in grades E-4 through E-6. The recomputed values were distributed against those supplied by the Alaskan Air Command. With the exception of one case, which was correctable, the recomputed values agreed with the original values.

5. Total weighted factors composite scores were computed by adding the relevant factors (see Appendix) in two ways: (*a*) by excluding the average board score and (*b*) by including the average board score. Results of the Phase I analysis had indicated conclusively that inclusion of a board component in the weighted factors composite would introduce only trivial changes in a comparable composite which excluded a board component. Thus, the weighted factors composite scores including the board component were computed and recorded, but were not used in any of the analyses. The weighted factors composite score excluding the board component is referred to as the Composite Score in the remainder of this report.

6. Within each grade, airmen were ranked on both the Composite Score and the Board Score. These created ranks were added to each record on the data tape. In general, the higher the score on a particular variable, the lower the corresponding rank value, For example, a rank value of 1 was assigned to the individual who had the highest score. Thus, high Composite Scores and high Board Scores are reflected in low rank values.

7. During the analysis, a list was obtained of the promotion-eligible airmen who were actually promoted. This information was added to the data tape as an additional score of *1* if the airman was promoted and *0* if he was not. The variable thus created served as the indicator of promotion action.

8. Data available for the weighted factors promotion system were distributed by single factors and by combinations of several factors. From the distribution by Control Air Force Specialty Code, groups with sufficient frequencies were selected as subgroups for more detailed analysis.

9. Since one of the major factors in actual promotion is the quota allocated to a particular specialty, grouping of cases by specialties within grade seemed to be essential for meaningful analysis. Thus, airmen were re-ranked within their particular specialties and grade on both the Composite Score and the Board Score. These new ranks were used only when the groups were analyzed within specialties.

III. ANALYSES

Relationship Between Board Score and Promotion Action

Traditionally, promotions have been made primarily on the basis of promotion board scores; however, if the promotion quota is either very high or very low, the board score is less of a determining factor. When the quota is high, for example, eligible airmen within a wide range of board scores from high to low are selected. If the quota is low, eligible airmen with both high and low board scores are not selected, while only those with the very highest scores are selected. When many eligible airmen receive tied board scores, but the quota does not permit all such airmen to be promoted, a promotion/non-promotion decision must be made. Promotion boards have generally accomplished this by taking a "second look" at the selection folders of the airmen with tied board

scores to consider other criteria in making the selections. For these reasons, it was anticipated that the relationship might be less than perfect between average board scores and promotion/non-promotion actions. To obtain empirical evidence on this question, the relationship between the Board Score and the actual promotion action was determined within each of several specialties and for the four grade levels involved.

The most widely used technique to ascertain relationships is computation of a coefficient of correlation. Correlation coefficients, obtained as a by-product of the regression analyses performed and reported separately under Phase I of this study (Koplyay, 1969), are shown in Table 1. Interpreting correlation coefficients, particularly when the correlation is between a continuous variable (such as Board Score) and a binary variable (such as promotion/non-promotion), is extremely difficult because the correlation not only depends on the strength of the relationship between the two variables, but it is also affected by other factors such as the "split" on the binary variable (e.g., the proportion of promoted airmen to non-promoted airmen) and the number of unique values on the non-dichotomized variable (e.g., the number of ties in Board Score). For example, in the case of grade E-3, specialty 702, it was known that 24 of the 25 eligible airmen were actually promoted. With the exception of one airman in this grade and specialty, all eligible airmen were promoted regardless of their Board Score. Thus, the computed correlation indicates a weak relationship between Board Score and promotion action. The correlation coefficients indicated in Table 1, therefore, should be interpreted with caution and in light of any circumstances which might yield spurious results.

From Table 1, it is apparent that the Board Scores correlated less than perfectly with the actual promotions within grade. Correlations within grade by selected specialties ranged from .1989 to .8029, showing both relatively low and relatively high correlations. As already suggested, however, these correlations reflect a somewhat blurred picture of the precise relationship between the Board Score and actual promotion. The low values could be a result of any one or all of several reasons: (*a*) extreme split between promoted and non-promoted subgroups, (*b*) tied Board Scores among those competing for promotions, and (*c*) inversions in which eligible airmen with lower Board Scores were promoted over airmen with higher Board Scores. Further analysis of the data indicated that there were only two inversions; hence, this reason can be eliminated as a factor to account for the observed low correlations. There were, however, occasional extreme splits and a high incidence of ties in Board Score (as discussed in Phase I of this study), and apparently these are the major factors accounting for the low correlations which do exist.

There is one other possible explanation for the less than perfect relationship between Board Scores and the actual promotion actions. The results of Phase I of the study had revealed statistically significant differences between the means of the Board Scores for the two bases, Elmendorf and Eielson, for airmen in grade E-3. Since these differences only existed for grade E-3, and the promotion/non-promotion split for this grade was consistently extreme across specialties, it was felt that possible effects of differences in Board Score means (which generally were numerically small although statistically significant) could not have been completely separated from

Table 1. **Correlations Between Board Score and Promotion Action Within Each Pay Grade for Total Sample and for Selected Specialties**

Pay Grade	Correlation by Pay Grade	Correlation by Specialty Subdivision					
		431	631	645	647	702	811
E-3	.4709	.5145	.4538	.6563	.6450	.1989	.5273
E-4	.5620	.8029	.5638	.7124	.5590	.7259	.5426
E-5	.5609	.7101	.3365	.5469	.7324	.7016	.7199
E-6	.5194	.5675	.6283	.7495	.7255	.4879	.3864

the adverse effect of the extreme splits on the correlation between Board Score and actual promotion action. Furthermore, subsequent analyses indicated that, with the exception of two inversions (i.e., cases in which airmen with lower Board Scores were promoted over airmen with higher Board Scores), all airmen who were promoted, regardless of their base of assignment, had Board Scores as high as or higher than those who were not promoted. This finding seemed to justify the conclusion that extreme promotion/non-promotion splits are mainly responsible for the less than perfect correlation between Board Score and promotion action as shown in this study.

Agreement Between Promotion Predictions and Actual Promotion Outcomes Within Pay Grades

Another phase of the analysis dealt with the validation of the Composite Score against actual selection, and then comparison of that relationship with the relationship between Board Score and promotion action. To appraise the validity of the proposed weighted factors composite score, it was assumed that the system had, in fact, been used as the basis for determining promotion/non-promotion decisions. The resulting outcomes derived from this hypothetical application of the system would then be considered "predictions" of the selection/non-selection outcomes as indicated by the actual promotion actions. Thus, if an eligible airman would have been promoted by the proposed system and was, in fact, promoted, then the proposed system provided a correct prediction of the promotion outcome. The validity of the proposed system is operationally defined for the purpose of this analysis in terms of the number of correct promotion predictions and the proportion of correct promotion predictions. Ranks on the Composite Score were used as the basis for selecting individuals to receive hypothetical promotions under the proposed system.

To ascertain the predictive efficiency of the proposed system, a validity index was computed by identifying those individuals who would have been selected for promotion by both the Composite Score and the Board Score. The ratio of the number of such individuals to the actual number of promotions is operationally defined as promotion overlap. Table 2 summarizes the correct promotion predictions, or promotion overlap, for the Composite Score by pay grade.

An example drawn from the data in Table 2 will illustrate the predictive validation. For grade E-5, the number of correct promotion predictions of the proposed system was determined by distributing and ranking the Composite Scores of the 514 E-5 airmen. With a promotion quota of 89, the 89 airmen with the highest scores would presumably have been selected for promotion and the remaining 425 non-selected. Of the 514 airmen in grade E-5, 56 airmen were selected for promotion by both the Composite Score and the Board Score. This represents a promotion overlap of 62.9 percent (or 56/89). In other words, 62.9 percent of those airmen whose rank on the Board Score was better than or equal to the promotion quota of 89 were also ranked among the top 89 on the Composite Score. Although this does not mean that these 56 airmen received the same rank on both Composite Score and Promotion Score, the end result of promotion selection would be the same. That is, one airman could have been ranked 1 on the Composite Score and 89 on the Board Score; nevertheless, he would have been selected for promotion by either system since the quota was 89.

Table 2. **Correct Promotion Predictions by Composite Score Within Each Pay Grade**

Pay Grade	Number Eligible	Number Promoted	Correct Predictions by Composite Score	Promotion Overlap	
				Proportion of Correct Predictions to Promotions	Percentage of Overlap
E-3	555	478	437	437/478	91.4
E-4	850	212	141	141/212	66.5
E-5	514	89	56	56/89	63.9
E-6	317	46	20	20/46	43.5

If there were one single promotion quota for each pay grade, rather than different quotas for different specialties as is the case, the data in Table 2 would adequately answer the question of validity of the proposed system. In general, the results in Table 2 indicate only a moderate level of validity of the system for actual promotion/non-promotion outcomes, with the percentage of correct promotion predictions ranging from 43.5 percent to 91.4 percent. Furthermore, this overlap in promotion predictions is less than 70 percent for three of the four grades in question. These results, however, should be considered as lower-limit estimates for the validity of the proposed system and should be interpreted with caution since the existing promotion system does operate on the basis of differential quotas. All the airmen within a pay grade are ranked on promotion board score, and then the quota for each specialty is filled going down the list from high score to low. Under this system, it is quite possible that airmen with high promotion board scores will not be promoted and airmen with lower board scores will be promoted.

To clarify this, let us assume that a particular airman ranks 10 on promotion board score, and five of his fellow airmen in the same specialty rank 9 or better on the board score. Suppose, further, that this particular specialty has a quota of four promotions. The airman in question will not be promoted since there are five persons in his specialty who rank better than he does on the board score. Now, let us assume that another airman, who is in the same pay grade as the first airman but in a different specialty, ranks 55 on the board score. Assuming, further, that this second airman's specialty has a quota of five promotions and that no other airman in his group has a rank better than 55 on the board score, this airman will be promoted since his board score rank is the highest within his specialty. The promotion outcome is favorable for the second airman and unfavorable for the first airman in spite of the fact that he had a better promotion board score in terms of the comparison across pay grade.

Agreement Between Promotion Predictions and Actual Promotion Outcomes Within Selected Specialties

Because of the differences by specialty, a further step was undertaken to analyze the relationship between the Composite Score and Board Score in terms of correct promotion predictions within particular specialties. Two new variables were created: rank on the Composite Score and rank on the Board Score within specialties.

The distribution of airmen by Control Air Force Specialty Codes did not provide an adequate sample for all the specialties in the study. Most of the specialties did not have enough individuals within each pay grade to permit a meaningful analysis. It was possible, however, to select six specialties with a large enough sample within each pay grade for further analysis. The same procedures as used in the comparison for the total sample were used for the within-specialty analyses. The only exception was that each airman was re-ranked on the Composite Score and the Board Score within his specialty.

Table 3 summarizes the promotion predictions within grade and by selected specialties. These results clearly imply that there was a very high degree of agreement in promotion prediction between the Composite Score and the Board Score. The lowest promotion overlap was 83.33 percent, and in 16 out of the 24 specialty-by-grade combinations, the agreement was 100 percent. One must conclude that the Composite Score would have promoted the same individuals in the 16 specialties analyzed as did the Board Score. Within the remaining 8 specialties, the overlap of predicted promotions ranged from 83.33 percent to 96.84 percent.

Analysis of the specialties in which agreement fell short of 100 percent indicates that the policy used in breaking tied promotion board scores was not applied with complete consistency. This may account for a small number of cases which were predicted for promotion by the Board Score but not by the Composite Score, and vice versa. Also, it appears that in some few cases the board rated an individual high if his Airman Performance Report variable was high, regardless of low scores on other variables. In short, the same factors which contribute t he lack of complete visibility of the selection criteria under the promotion board system probably also account for the less than perfect relationship between the Composite Score and the Board Score.

Sample Cases of Inconsistencies Between Composite Scores and Board Scores

To illustrate the occasional inconsistencies of the promotion board scores in light of the components of the weighted factors system, the scores and ranks of four airmen in grade E-4 are compared in Table 4. It is apparent from the table that Airman A's performance was clearly much

Table 3. **Correct Promotion Predictions by Composite Score for Selected Specialties Within Each Pay Grade**

Specialty	Number Eligible	Number Promoted	Promotion Overlap: Correct Predictions by Composite Score	Promotion Overlap: Proportion of Correct Predictions to Promotions	Promotion Overlap: Percentage of Overlap
			Pay Grade E-3		
431	49	46	44	44/46	95.6
631	23	22	22	22/22	100.0
645	41	37	37	37/37	100.0
647	32	29	28	28/29	96.6
702	25	24	24	24/24	100.0
811	108	95	92	92/95	96.8
			Pay Grade E-4		
431	55	28	25	25/28	89.3
631	74	6	5	5/6	83.3
645	57	9	8	8/9	88.9
647	35	4	4	4/4	100.0
702	50	11	10	10/11	90.9
811	35	4	4	4/4	100.0
			Pay Grade E-5		
431	34	13	13	13/13	100.0
631	42	1	1	1/1	100.0
645	44	10	10	10/10	100.0
647	10	2	2	2/2	100.0
702	42	6	5	5/6	83.3
811	25	3	3	3/3	100.0
			Pay Grade E-6		
431	31	2	2	2/2	100.0
631	17	2	2	2/2	100.0
645	25	5	5	5/5	100.0
647	11	3	3	3/3	100.0
702	33	3	3	3/3	100.0
811	13	2	2	2/2	100.0

Table 4. **Comparison of Composite Score and Board Score Variables for Four Sample Cases**

Variable	Sample Cases			
	Airman A	Airman B	Airman C	Airman D
Specialty Knowledge Test Score	80	30	95	60
Promotion Fitness Examination Score	85	15	95	75
Decorations Score	0	0	0	0
Airman Performance Report Score	125	128	135	135
Time-in-Grade Score	44	10	12	7
Time-in-Service Score	23	7	8	6
Composite Score Rank	2	792	8	256
Board Score Rank	759	77	230	2
Promotion Action	0	1	1	1

superior to Airman B's. In fact, Airman B scored very poorly in general. Yet, Airman A ranked 759 on the Board Score and was not promoted. Airman B, on the other hand, ranked 77 on the Board Score (792 on the Composite Score) and was promoted.

Airman C obtained scores far superior to those of Airman D. Although both were promoted, C ranked 230 on the Board Score (with superior performance on the Composite Score); D ranked 2 on the Board Score (with poor performance on the Composite Score).

The inconsistencies which are present in the sample indicate that the board must be evaluating some "invisible" additional factors besides those included in the weighted factors composite in these cases. Since rankings on the Board Score in the total sample within grade (across specialties) are not influenced by quotas assigned to the specialties, inferences about inconsistencies in Board Score rankings are valid. Although it is clear in these cases that the Board Score reflects a weighting of information from the selection folder which is not included in the Composite Score, it should be reemphasized that the actual promotion outcome is a function not only of the Board Score but also of the quota assigned to a specialty. Thus, while a low Board Score decreases the likelihood of promotion, and a high Board Score increases the likelihood of promotion, it does not necessarily follow that a high rank-value on the Board Score results in non-promotion and a low rank-value on the Board Score guarantees promotion. That is, a rank (within grade) of 230 (Airman C in Table 4) could have represented a relative rank (within specialty) good enough to be promoted based on the quota for that specialty.

Analysis of Rank Discrepancies

The sample within each grade was divided into four mutually exclusive groups based on ranks on the Composite Score and the Board Score:

> Group 1. Individuals whose ranks on both scores were less than or equal to the promotion quota.
>
> Group 2. Individuals whose rank on the Composite Score was less than or equal to the promotion quota, and whose rank on the Board Score was greater than the promotion quota.
>
> Group 3. Individuals whose rank on the Composite Score was greater than the promotion quota, and whose rank on the Board Score was less than or equal to the promotion quota.
>
> Group 4. Individuals whose ranks on both scores were greater than the promotion quota.

Groups 1 and 4 are the "agreement" groups; groups 2 and 3 are the "discrepancy" groups. The latter groups, 2 and 3, were analyzed on the components of the weighted factors composite score. The results of these analyses are summarized in Table 5.

Table 5. **Analysis of Weighted Factors for Discrepancy Groups in Which Composite Score and Board Score Ranks Were Not in Agreement on Promotion Action**

(Significance of Difference Between Means of Weighted Factors)

Discrepancy Group[a]	E-3 N	E-3 Mean	E-3 SD	E-3 Significance Level	E-4 N	E-4 Mean	E-4 SD	E-4 Significance Level	E-5 N	E-5 Mean	E-5 SD	E-5 Significance Level	E-6 N	E-6 Mean	E-6 SD	E-6 Significance Level
Specialty Knowledge Test Score																
2	48	64.0	18.7	.001	130	80.4	12.8	.001	63	80.6	15.0	.01	38	87.5	9.2	.01
3	41	43.3	12.2		146	59.6	19.0		73	66.7	17.6		34	67.9	18.9	
Promotion Fitness Examination Score																
2	48	57.4	25.5	.001	130	78.1	17.6	.001	63	82.1	13.4	.001	38	82.1	13.7	.01
3	41	12.9	12.2		146	37.0	23.6		73	47.8	25.4		34	58.5	26.1	
Decorations Score																
2	48				130				63	5.2	7.0		38	4.3	3.3	
3	41				146				73	3.2	0.7		34	6.2	6.6	
Airman Performance Report Score																
2	48	98.3	15.3		130	123.7	10.3		63	125.1	7.9		38	130.7	5.5	
3	41	117.0	14.6	.001	146	128.7	7.2	.01	73	131.3	3.4	.01	34	133.6	1.7	.01
Time-in-Grade Score																
2	48	8.1	1.6		130	15.6	13.7	.01	63	38.6	18.4	.01	38	30.6	15.6	.01
3	41	8.8	1.8		146	11.4	6.3		73	25.2	11.6		34	18.2	6.9	
Time-in-Service Score																
2	48	5.1	.5		130	12.2	8.5	.01	63	32.0	5.4	.01	38	35.3	3.6	.01
3	41	5.3	.9		146	9.1	4.3		73	25.2	6.5		34	32.0	5.8	

[a]Group 2: Composite Score rank $\leq$ quota; Board Score rank $>$ quota.
Group 3: Composite Score rank $>$ quota; Board Score rank $\leq$ quota.

Comparison of the groups in terms of the six components of the weighted factors composite score reveals the following findings.

1. *Specialty Knowledge Test Scores.* Group 2 (high Composite Scores but low Board Scores) was superior to group 3 (low Composite Scores but high Board Scores) in all grades. The means differed by more than 20 points except in grade E-5 where the difference was 13.9 points. In all cases, the differences were statistically significant.

2. *Promotion Fitness Examination Scores.* The means of group 2 were superior to the means of group 3 in all grades. The differences ranged from 23.6 points (E-6) to 44.5 points (E-3).

3. *Decorations Scores.* There were no statistically significant differences between the means of group 2 and group 3.

4. *Airman Performance Report Scores.* There was a statistically significant difference between means of group 2 and group 3 in favor of group 3 in all grades. These differences, however, were relatively small numerically (18.7 for E-3, 5.0 for E-4, 6.2 for E-5, and 2.9 for E-6).

5. *Time-in-Grade Scores.* With the exception of grade E-3, means of group 2 and group 3 differed significantly in favor of group 2 in all grades.

6. *Time-in-Service Scores.* Means of group 2 and group 3 differed significantly in favor of group 2 in all grades except grade E-3. The difference was relatively small but statistically significant.

With the exception of the Decorations factor, where the two discrepancy groups were comparable, and the Airman Performance Report factor, where a small but significant difference in favor of group 3 was found, group 2 was superior on all factors.

IV. SUMMARY

The weighted factors promotion system was field-tested with the cooperation of the Alaskan Air Command. From among 2,835 promotion-eligible airmen at Elmendorf and Eielson Air Force Bases, a final sample of 2,290 airmen in grades E-3 through E-6 was obtained. Data were analyzed to determine the relationship between the promotion board score (Board Score) and the weighted factors composite score excluding the board score (Composite Score). In addition, actual promotion actions were related to promotion board scores. Overlaps between rank on the Board Score and rank on the Composite Score were analyzed for the entire sample within each grade and for selected specialties. Discrepancies in ranks for a few individual cases were further analyzed.

The results of the various analyses are summarized, and several conclusions are drawn regarding the relationship between the existing airman promotion system based on board evaluations and the weighted factors promotion system.

1. The relationship between the Board Score and actual promotion was less than perfect. Correlations ranged between .471 and .562 for the total sample. For selected specialties, the range was from .199 to .803. Although ties on the Board Scores may have been partially responsible for the observed low to moderate correlations, it is felt that the different promotion quotas for different specialties probably account for additional variability in the relationship between Board Score and actual promotion.

2. Promotion overlap between Composite Score and Board Score ranged from 43 percent for grade E-6 to 91 percent for grade E-3 for the total sample. Further analysis within specialties resulted in almost complete overlap. When airmen were re-ranked on the Composite Score and on the Board Score within their specialties, the overlap was 100 percent in 16 out of the 24 groups analyzed. The overlap ranged between 84 percent and 96 percent in the other eight groups. This does not necessarily imply that the ranks on Board Score and Composite Score were the same. It does imply, however, that when re-ranked within a particular specialty, practically the same airmen would have been selected for promotion by both the Board Score alone and the Composite Score excluding the Board Score. Thus, it is apparent that the proposed weighted factors promotion system is highly valid in the sense that it provides results which are in close agreement with the operational system.

3. Analyses of individual cases indicated occasional inconsistencies on the part of the promotion board in assigning Board Scores on the basis of the factors included in the weighted factors composite score. In some cases, airmen with superior scores on these factors were ranked lower by the board than others whose scores reflected poor performance.

4. Most airmen either ranked high on both the Board Score and the Composite Score, or they ranked low on both. A relatively small number of cases ranked high on the Composite Score and low on the Board Score, while another small number

ranked high on the Board Score and low on the Composite Score. Comparison of these rank-discrepancy groups revealed that, with the exception of the Airman Performance Report variable and the Decorations variable, the average score on each factor was higher for the group in which the rank discrepancy was in favor of the Composite Score than in the reverse discrepancy group. The Airman Performance Report mean was slightly higher in the group which ranked high on the Board Score and low on the Composite Score. However, the margin by which the Airman Performance Report factor was higher was relatively slight compared to the large differences on other factors revealed when the rank-discrepancy groups were analyzed. The Decorations factor was approximately equal in the two groups.

To summarize the overall findings, then, the weighted factors composite score excluding the average board score gave most airmen the same relative ranking within their specialty as did the promotion board score. In other words, the same individuals would have been promoted using either system. On the other hand, when all promotion-eligible airmen within a pay grade were compared with each other, there were indications of inconsistencies in the promotion board's judgment of the relative merits of performance in arriving at the promotion/non-promotion decision. There was a definite lack of visibility of selection factors in a few cases where airmen with superior Composite Scores were given low Board Scores. This does not imply that the promotion board had no valid reason for its judgment. It does suggest, however, that the reason would not be readily apparent to an airman under the current operational board process.

Validation of the weighted factors promotion system was accomplished by ranking the individuals on their Composite Scores and comparing these ranks to actual promotion outcomes. It was concluded from the results that the weighted factors promotion system would have promoted almost the same individuals within the specialties analyzed as were actually selected by the promotion boards. If the sample in the study can be considered to be representative of the Air Force-wide population of promotion-eligible airmen in grades E-3 through E-6, it can be further assumed that the weighted factors system provides a valid promotion system in which the selection criteria are visible.

REFERENCE

Koplyay, J.B. *Field test of the weighted airman promotion system: Analysis of the promotion board component in the weighted factors system.* AFHRL-TR-69-101, AD-689 751. Lackland AFB, Tex.: Tex.: Personnel Research Division, Air Force Human Resources Laboratory, April 1969.

APPENDIX: AIRMAN PROMOTION SELECTION FACTORS AND POINTS[a]

Grades E-4 through E-7

Selection Factor	Computation With Board Score		Computation Without Board Score	
	Maximum Points	Percentage	Maximum Points	Percentage
Specialty Knowledge Test (SKT) Score	95	17	95	21
Promotion Fitness Examination (PFE) Score	95	17	95	21
Time-In-Service (TIS) Score	40	7	40	9
Time-In-Grade (TIG) Score	60	11	60	13
Decoration Score	25	5	25	6
Airman Performance Reports (APR)	135	25	135	30
Board Evaluation	100	18		
	550	100	450	100

Explanation of Factors

The SKT and PFE will be administered annually.

Points for the SKT and PFE scores will be actual percentile scores obtained in these tests (in 5-point increments).

Time-in-Service will be computed by multiplying years of Total Active Federal Military Service by 2. Less than 6 months will count as 1 point; over 6 months will count a full year, 2 points. A cutoff score of 40 points, for 20 years TAFMS, has been established.

Time-in-Grade will be computed at the rate of ½ point per month up to a maximum of 120 months, 60 points; 15 days or less will be dropped, 16 or more will count as a full month.

Decorations will be assigned points according to their order of precedence. The maximum number of points attainable is 25. Decorations will count for promotion regardless of the military service in which they were earned.

The Airman Performance Report score is obtained by multiplying the overall evaluation mean by 15. The mean is based on reports for a 5-year period prior to the eligibility date, not to exceed ten reports.

The Board Score will be based on a review by the board that concentrates on those items not previously weighted; e.g., education level and efforts to improve self in terms of formal education, technical knowledge, etc. Reduced selection folder will consist of Category A favorable communications, APR word picture, and pages 2 and 4 of the Air Force Form 7.

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[a]From Koplyay, 1969, p. 11.